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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/750,804	12/29/2000	Shiquan Wu	NTL-3.2.142/3516	8286

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EXAMINER	
PHUNKULH, BOB A	
ART UNIT	PAPER NUMBER
2661	

DATE MAILED: 04/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/750,804	WU ET AL.	
	Examiner	Art Unit	
	Bob A. Phunkulh	2661	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 December 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-67* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *66 and 67* is/are allowed.

6)☒ Claim(s) *1,2,7-12,14,19-21,26-31,36-41,43-45,54-65* is/are rejected.

7)☒ Claim(s) *3-6,13,15-18,22-25,30,32-35 and 46-53* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This communication is in response to applicant's 12/20/2004 amendment(s)/response(s) in the application of **WU et al.** for "**ADAPTIVE TIME DIVERSITY AND SPATIAL DIVERSITY FOR OFDM**" filed 12/29/2000. The amendments/response to the claims have been entered. No claims have been canceled. Claims 37-67 have been added. Claims 1-67 are now pending.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2, 7-8, 9-12, 14, 19-21, 26-31, 36-41, 43-45, 54-65 are rejected under 35 U.S.C. 102(e) as being anticipated by Heath, Jr. et al. (US 6,298,092), hereinafter Heath.

Regarding claims 1 and 20, Heath discloses an apparatus for use with an adaptive orthogonal frequency division-multiplexing (OFDM) system that uses multiple input multiple output (MIMO) structure to transmit OFDM signals from a plurality of transmitters to a plurality of receivers antennas, the OFDM signal having an OFDM

frame of a duration, the OFDM frame having data packets and a is plurality of OFDM slots, each of the OFDM slots having a plurality of OFDM symbols that include a plurality of sub-carriers, the apparatus comprising:

a receiver that responds to receipt of the OFDM signal by making a determination for a sub-carrier of the plurality of sub-carriers as to whether time diversity or spatial diversity should be used for subsequent transmissions and transmits a feedback signal indicative of that determination, wherein OFDM signals that are transmitted on the sub-carrier over multiple ones of the transmitter antennas are independent of each other for the spatial diversity and correspond to each other for the time diversity (*figures 4, 5A-5B show the each receiver receiving the transmitted signal and computing the channel parameters by computations means 104, where the computation includes selection of mapping scheme for subsequent transmission by the transmitter, the selection of mapping scheme includes selecting between diversity coding or spatial multiplexing (spatial diversity) and the selection is feedback to the transmitter*, see col. 3 line 56 to col. 4 line 8-15; and col. 11 lines 23-38).

Regarding claims 2 and 21, Heath disclose the receiver makes the determination based on the a comparison of a channel condition with a threshold (see col. 4 lines 23-30), the channel condition being based on the frequency response channel matrix that is derived from OFDM symbols (determination of the channel coefficients matrix H, see col. 3 lines 34-45).

Regarding claim 7, Heath discloses the channel estimator that forms the frequency response channel matrix (see col. 3 lines 34-45).

Regarding clams 8 and 26, Heath discloses the controller is configured to classified each sub-carrier of the plurality of sub-carriers into one of two group in accordance with a respective channel condition for the sub-carriers, one of the two groups being indicative of time diversity and spatial diversity (*mapping schemes in this embodiment can include random or determined assignment of transmit signals TS_p to k of the M transmit antennas as discussed above both in case of diversity coding and spatial multiplexing*, **see col. 4 lines 48-51**).

Regarding claims 37 and 38, Heath discloses the controller is further configured to determine a modulation scheme on each of the plurality of sub-carriers based on an estimated ratio selected from a group consisting of carrier-to-interference ratio and a signal to noise ratio (see claims 2, 18-19).

Regarding claims 40 and 43, Heath discloses the subsequent transmission comprises transmission units comprising M OFDM symbols, where M is the number of transmitter antennas in the OFDM system (see col. 3 lines 26-34).

Regarding clams 54 and 57, Heath discloses the receiver responds to receipt of the OFDM signal by making a determining for a subset of the plurality of sub-carriers as

to whether time diversity or spatial diversity should be used for subsequent transmission of on the subset of the sub-carriers (*mapping schemes in this embodiment can include random or determined assignment of transmit signals TS_p to k of the M transmit antennas as discussed above both in case of diversity coding and spatial multiplexing*, **see col. 4 lines 48-51**).

Regarding claims 60 and 63, Heath discloses the receiver responds to receipt of the OFDM signal by making a determination for sub-carriers of an OFDM symbol from the plurality of OFDM symbols as to whether time diversity or spatial diversity should be used for subsequent transmission on the sub-carriers of the OFDM symbol (*figures 4, 5A-5B show the each receiver receiving the transmitted signal and computing the channel parameters by computations means 104, where the computation includes selection of mapping scheme for subsequent transmission by the transmitter, the selection of mapping scheme includes selecting between diversity coding or spatial multiplexing (spatial diversity) and the selection is feedback to the transmitter*, see col. 3 line 56 to col. 4 line 8-15; and col. 11 lines 23-38).

Regarding claims 9 and 27, Heath discloses an apparatus for use with an adaptive orthogonal frequency division-multiplexing (OFDM) system that uses multiple input multiple output (MIMO) structure to transmit OFDM signals from a plurality of transmitters to a plurality of receivers, the OFDM signal having an OFDM frame of a duration, the OFDM frame having data packets and a plurality of OFDM slots, each of

the OFDM slots having a plurality of OFDM symbols that include a plurality of sub-carriers, the apparatus comprising

at least one controller (controller 66) configured and arranged to respond to a feedback signal (receives at the feedback extractor 80), the feedback signal indicative of a determination for a sub-carrier of the plurality of sub-carriers as to whether time diversity or spatial diversity should be used for subsequent transmission on the sub-carrier, to direct an encoder to assign constellation points for the time diversity or the spatial diversity to the sub-carrier, the encoder including a space time transmitter diversity (STTD) encoder (diversity coding 64) and a spatial multiplexing (SM) encoder (spatial multiplexing 62), the STTD encoder being arranged to encode the sub-carriers in accordance with the time diversity and the SM encoder being arranged to encode the sub-carriers classified in the other of the groups in accordance with the spatial diversity, wherein the OFDM data signals that are transmitted over multiple ones of the transmitter antennas are independent of each other for the spatial diversity and correspond to each other for the time diversity (*figures 4, 5A-5B show the each receiver receiving the transmitted signal and computing the channel parameters by computations means 104, where the computation includes selection of mapping scheme for subsequent transmission by the transmitter, the selection of mapping scheme includes selecting between diversity coding or spatial multiplexing (spatial diversity) and the selection is feedback to the transmitter*, see col. 3 line 56 to col. 4 line 8-15; and col. 11 lines 23-38).

Regarding claim 10, Heath discloses the controller is configured to determine a modulation scheme on each of the sub-carriers based on an estimated ratio selected from a further group consisting of a carrier to interference ratio and a signal to noise ratio (see claims 2, 18-19).

Regarding clam 28, Heath discloses the controller is configured to classified each sub-carrier of the plurality of sub-carriers into one of two group in accordance with a respective channel condition for the sub-carriers, one of the two groups being indicative of time diversity and spatial diversity (*mapping schemes in this embodiment can include random or determined assignment of transmit signals TS_p to k of the M transmit antennas as discussed above both in case of diversity coding and spatial multiplexing*, **see col. 4 lines 48-51**).

Regarding claim 39, Heath discloses the controller is further configured to determine a modulation scheme on each of the plurality of sub-carriers based on an estimated ratio selected from a group consisting of carrier-to-interference ratio and a signal to noise ratio (see claims 2, 18-19).

Regarding claims 41, and 44, Heath discloses the subsequent transmission comprises transmission units comprising M OFDM symbols, where M is the number of transmitter antennas in the OFDM system (see col. 3 lines 26-34).

Regarding clams 55 and 58, Heath discloses the receiver responds to receipt of the OFDM signal by making a determining for a subset of the plurality of sub-carriers as to whether time diversity or spatial diversity should be used for subsequent transmission of on the subset of the sub-carriers (*mapping schemes in this embodiment can include random or determined assignment of transmit signals TS_p to k of the M transmit antennas as discussed above both in case of diversity coding and spatial multiplexing*, **see col. 4 lines 48-51**).

Regarding claims 61 and 64, Heath discloses the receiver responds to receipt of the OFDM signal by making a determination for sub-carriers of an OFDM symbol from the plurality of OFDM symbols as to whether time diversity or spatial diversity should be used for subsequent transmission on the sub-carriers of the OFDM symbol (*figures 4, 5A-5B show the each receiver receiving the transmitted signal and computing the channel parameters by computations means 104, where the computation includes selection of mapping scheme for subsequent transmission by the transmitter, the selection of mapping scheme includes selecting between diversity coding or spatial multiplexing (spatial diversity) and the selection is feedback to the transmitter*, see col. 3 line 56 to col. 4 line 8-15; and col. 11 lines 23-38).

Regarding claims 11 and 29, Heath discloses an apparatus for use with an adaptive orthogonal frequency division multiplexing (OFDM) system that uses multiple input multiple output (MIMO) structure to transmit OFDM signals from a plurality of

transmitters to a plurality of receivers, the OFDM signal having an OFDM frame of a duration, the OFDM frame having data packets and a plurality of OFDM slots, each of the OFDM slots having a plurality of OFDM symbols that include a plurality of sub-carriers, the apparatus comprising:

controllers (the combination of receive processing unit 98; channel estimator 100, channel parameters computation 104; and selection block 106) configured and arranged to direct transmission and reception in accordance with OFDM, the controllers including those associated with the reception that are configured to responds receipt of the OFDM signal by making a determination as to whether time diversity or spatial diversity should be used for subsequent transmissions and transmits a feedback signal (feed back 118, see figure 5A) indicative of that determination, wherein OFDM signals that are transmitted over multiple ones of the transmitters are independent of each other for the spatial diversity and correspond to each other for the time diversity, the controllers including those associated with the transmission that are responsive to receipt of the feedback signal to direct an encoder to assign constellation points for either the time diversity or the spatial diversity to the sub-carriers, the encoder including a space time transmitter diversity (STTD) encoder and a spatial multiplexing (SM) encoder, the STTD encoder being arranged to encode the sub-carriers in accordance with the time diversity and the SM encoder being arranged to encode the sub-carriers in accordance with the spatial diversity (*figures 4, 5A-5B show the each receiver receiving the transmitted signal and computing the channel parameters by computations means 104, where the computation includes selection of mapping scheme for subsequent*

transmission by the transmitter, the selection of mapping scheme includes selecting between diversity coding or spatial multiplexing (spatial diversity) and the selection is feedback to the transmitter, see col. 3 line 56 to col. 4 line 8-15; and col. 11 lines 23-38).

Regarding claims 12 and 36, Heath discloses the controller is configured to determine a modulation scheme on each of the sub-carriers based on an estimated ratio selected from a further group consisting of a carrier to interference ratio and a signal to noise ratio (see claim 2, 18-19).

Regarding claim 14, 31, Heath disclose the receiver makes the determination based on the a comparison of a channel condition with a threshold (see col. 4 lines 23-30), the channel condition being based on the frequency response channel matrix that is derived from OFDM symbols (determination of the channel coefficients matrix H, see col. 3 lines 34-45).

Regarding claim 19, Heath discloses the channel estimator that forms the frequency response channel matrix (see col. 3 lines 34-45).

Regarding claims 42, 45, Heath discloses the subsequent transmission comprises transmission units comprising M OFDM symbols, where M is the number of transmitter antennas in the OFDM system (see col. 3 lines 26-34).

Regarding clams 56, 59, Heath discloses the receiver responds to receipt of the OFDM signal by making a determining for a subset of the plurality of sub-carriers as to whether time diversity or spatial diversity should be used for subsequent transmission of on the subset of the sub-carriers (*mapping schemes in this embodiment can include random or determined assignment of transmit signals TS_p to k of the M transmit antennas as discussed above both in case of diversity coding and spatial multiplexing*, **see col. 4 lines 48-51**).

Regarding claims 62 and 65, Heath discloses the receiver responds to receipt of the OFDM signal by making a determination for sub-carriers of an OFDM symbol from the plurality of OFDM symbols as to whether time diversity or spatial diversity should be used for subsequent transmission on the sub-carriers of the OFDM symbol (*figures 4, 5A-5B show the each receiver receiving the transmitted signal and computing the channel parameters by computations means 104, where the computation includes selection of mapping scheme for subsequent transmission by the transmitter, the selection of mapping scheme includes selecting between diversity coding or spatial multiplexing (spatial diversity) and the selection is feedback to the transmitter*, see col. 3 line 56 to col. 4 line 8-15; and col. 11 lines 23-38).

Allowable Subject Matter

Claims 3-6, 13, 15-18, 22-25, 30, 32-35, 46-53, are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in

independent form including all of the limitations of the base claim and any intervening claims.

Claims 66-67 are allowed.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any response to this action should be mailed to:

The following address mail to be delivered by the United States Postal Service (USPS) only:

Mail Stop _____
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

or faxed to:

(703) 872-9306, (for formal communications intended for entry)

Or:

The following address mail to be delivered by other delivery services (Federal Express (Fed Ex), UPS, DHL, Laser, Action, Purolater, Hand Delivery, etc.) as follow:

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220 20th Street South
Customer Window, Mail Stop _____
Crystal Plaza Two, Lobby, Room 1B03
Arlington, VA 22202.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Bob A. Phunkulh** whose telephone number is **(571) 272-3083.** The examiner can normally be reached on Monday-Tursday from 8:00 A.M. to 5:00 P.M. (first week of the bi-week) and Monday-Friday (for second week of the bi-week).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor **Chau Nguyen**, can be reach on **(571) 272-3126.** The fax phone number for this group is **(703) 872-9306.**

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Bob A. Phunkulh

TC 2600
Art Unit 2661
April 11, 2005

BOB PHUNKULH
PRIMARY EXAMINER